

## PATENT ABSTRACTS OF JAPAN

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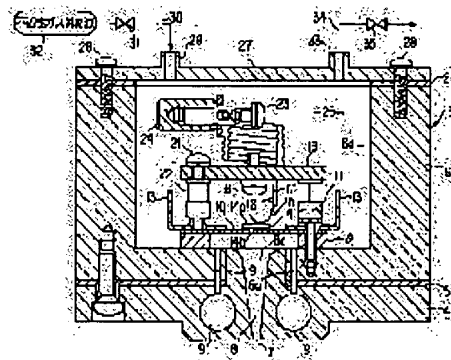
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## (54) ULTRASONIC WASHER

## (57)Abstract:

PROBLEM TO BE SOLVED: To prevent the oxidation of an electrode part and a feeder member of a piezoelectric element and also to remove fine particles stuck on a material to be washed with a high degree of efficiency by forming an enclosed space for housing a piezoelectric element and a feeder member in a washing nozzle and making the inside of the enclosed space under inert gas atmosphere or dry air atmosphere.

SOLUTION: A prismatic washing nozzle 3 mounted on a conveyor has a planar lower material 4 and a prismatic upper material 6 having a recessed part 6a on the upper surface thereof, and a washing liquid jetting port 7 is provided on the back surface of the lower material 4. A washing liquid flows through liquid supply paths 9 and flows into an end opening 8a of a diffuser space 8, and a thin sheet vibrating body 10 is installed opposite to a washing liquid jetting port 7. A piezoelectric element 14 is installed in the central part of the upper surface of the vibrating body 10, and high frequency voltage supplied to a feeder terminal 24 from a high frequency power source is fed to the piezoelectric element 14 through a coil 23, a metal plate 19 and a feeder member 15. In an enclosed space 25 formed of a cover 27, air atmosphere is replaced with inert gas atmosphere.



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**[Brief Description of the Drawings]**

[Drawing 1] Drawing of longitudinal section of the washing nozzle shown in drawing 2 .

[Drawing 2] The perspective diagram of the ultrasonic cleaner concerning 1 operation gestalt of this invention.

**[Description of Notations]**

1 -- washed object and 2 -- -- a conveyer, 3 -- washing nozzle, 7 -- penetrant remover exhaust nozzle, and 8 -- -- diffuser space, a 10 -- oscillating object, 14 -- piezoelectric device, 14a, and 14b-- -- the polar zone, 15 -- electric supply member, 24 -- electric supply terminal, and 25 -- -- a closed space, 27 -- lid, 29 -- supplied-air nozzle, and 30 -- -- an airpipe, 31 -- supplied-air valve, 32 -- inert gas source of supply, and 33 -- -- an exhaust nozzle, 34 --

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Means for Solving the Problem] In order to solve the above-mentioned technical problem, invention of a claim 1 The washing nozzle which has the penetrant remover exhaust nozzle which spouts a penetrant remover to a washed object, The oscillating object of the tabular which countered the aforementioned penetrant remover exhaust nozzle and was fixed to the aforementioned washing nozzle, In the ultrasonic cleaner possessing the piezoelectric device which gives an ultrasonic wave to the penetrant remover which this oscillating object is vibrated and is spouted from the aforementioned penetrant remover exhaust nozzle, and the electric supply member which contacts the polar zone of this piezoelectric device and supplies electric power to the aforementioned piezoelectric device in high-frequency voltage The closed space which holds the aforementioned piezoelectric device and the aforementioned electric supply member in the aforementioned washing nozzle is formed, and it is characterized by making the inside of this closed space into inert gas atmosphere or dried-air atmosphere.

[0008] The washing nozzle for which invention of a claim 2 has the penetrant remover exhaust nozzle which spouts a penetrant remover to a washed object, The oscillating object of the tabular which countered the aforementioned penetrant remover exhaust nozzle and was fixed to the aforementioned washing nozzle, In the ultrasonic cleaner possessing the piezoelectric device which gives an ultrasonic wave to the penetrant remover which this oscillating object is vibrated and is spouted from the aforementioned penetrant remover exhaust nozzle, and the electric supply member which contacts the polar zone of this piezoelectric device and supplies electric power to the aforementioned piezoelectric device in high-frequency voltage While forming the closed space which holds the aforementioned piezoelectric device and the aforementioned electric supply member in the aforementioned washing nozzle It is characterized by establishing

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a flueing means to establish the gas supplied-air means which carries out the supplied air of inert gas or the dried air in this closed space, and to exhaust the aforementioned inert gas or the aforementioned dried air out of the aforementioned closed space.

[0009] Invention of a claim 3 is that the hydrostatic pressure in the aforementioned closed space is the same as that of the fluid pressure of the penetrant remover spouted from the aforementioned penetrant remover exhaust nozzle, or a thing characterized by the high thing in invention of a claim 1 or a claim 2.

[0010]

[Embodiments of the Invention] Hereafter, 1 operation gestalt of this invention is explained with reference to drawing 1 and drawing 2. Drawing 2 is the perspective diagram of the ultrasonic cleaner concerning 1 operation gestalt of this invention, and the conveyer by which one in drawing conveys a washed object and 2 conveys a washed object 1, and 3 show the washing nozzle of the prismatic which sprays a penetrant remover on the upper surface (washed field) of the washed object 1 laid on the conveyer 2 in the shape of a shower.

[0011] As the aforementioned washing nozzle 3 is shown in drawing 1, it has the lower material 4 of a tabular, the packing 5 prepared in the upper surface of this lower material 4, and the up material 6 of the prismatic which is fixed to the lower material 4 through this packing 5, and has crevice 6a on the upper surface, and the penetrant remover exhaust nozzle 7 is formed in the inferior surface of tongue of the aforementioned lower material 4.

[0012] Opening of the aforementioned penetrant remover exhaust nozzle 7 is carried out long and slender along the cross direction of a conveyer 2, and the diffuser space 8 for raising the fluid pressure of a penetrant remover is formed in the end of this penetrant remover exhaust

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nozzle 7.

[0013] Moreover, the aforementioned washing nozzle 3 has the penetrant remover feed hopper (not shown), and the penetrant remover which flowed from this penetrant remover feed hopper circulates the liquid supply way 9 formed in the interior of the washing nozzle 3, and flows into end opening 8a of the aforementioned diffuser space 8.

[0014] The oscillating object 10 of the shape of sheet metal which consists of metallic materials, such as a tantalum, counters the penetrant remover exhaust nozzle 7, and is prepared in end opening 8a of the aforementioned diffuser space 8. The periphery section of this oscillating object 10 is being fixed to the up material 6 of the washing nozzle 3 through packing 12 with two or more screw threads 11, and the piezoelectric device 14 is formed in the upper surface center section. And two or more pressure plates 13 are formed in the upper surface periphery section of the aforementioned oscillating object 10, and the aforementioned screw thread 11 is screwed in tapped hole 6a which penetrated the breakthrough formed in a pressure plate 13, the oscillating object 10, and packing 12, and was prepared in the inner base of the aforementioned crevice 6a.

[0015] The aforementioned piezoelectric device 14 is formed by piezoelectric material, such as a barium titanate, and the sheet metal-like polar zone 14a and 14b is formed in both sides of this piezoelectric device 14. these polar zone 14a and 14b is formed by metallic materials, such as aluminum, -- having -- \*\*\*\* -- polar-zone 14a -- electric supply -- the point of a member 15 has contacted In addition, polar-zone 14b is being fixed to the upper surface of the oscillating object 10 by conductive adhesives.

[0016] the aforementioned electric supply -- a member 15 bends the sheet metal which consists of metals, such as copper, in the shape of J character, is formed, and carries out [ the amount of

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point ] elastic deformation according to the oscillating phenomenon of a piezoelectric device 14 [0017] the aforementioned electric supply -- the end face section of a member 15 -- a screw thread 16 -- the metal of L typeface -- it is fixed to the member 17 this metal -- the member 17 is formed above the piezoelectric device 14, and is being fixed to the inferior surface of tongue of a metal plate 19 with the screw thread 18

[0018] The aforementioned metal plate 19 is supported above the piezoelectric device 14 with the insulating tube 22 which covers the thread part of two or more screw threads 21 which extended from the upper surface of a pressure plate 13, and this screw thread 21, and the end of a coil 23 is in contact with the upper surface of this metal plate 19. In addition, the nose of cam of the aforementioned screw thread 21 is in contact with the upper surface of the oscillating object 10.

[0019] The aforementioned coil 23 is formed by metallic materials, such as copper, and the electric supply terminal 24 is formed in the other end of this coil 23. and the high-frequency voltage which the non-illustrated RF generator is connected to the aforementioned electric supply terminal 24 through the electric supply cable (not shown), and was supplied to the electric supply terminal 24 from this RF generator -- a coil 23, a metal plate 19, and a metal -- a member 17 and electric supply -- pass a member 15 -- while electric power is supplied by polar-zone 14a of a piezoelectric device 14, pass a coil 23, a metal plate 19, a screw thread 21, and the oscillating object 10 -- electric power is supplied by polar-zone 14b of

[0020] the aforementioned oscillating object 10, a piezoelectric device 14, and electric supply -- the member 15, the metal plate 19, the coil 23, and the electric supply terminal 24 are held in crevice 6a formed in the up material 6 of the washing nozzle 3 This crevice 6a is airtightly sealed

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with the lid 27 prepared in the upper surface of the up material 6 through packing 26, and forms a closed space 25 with this lid 27.

[0021] The aforementioned lid 27 is being fixed to the upper surface of the up material 6 with two or more screw threads 28, and the supplied-air nozzle 29 is formed in this lid 27. The inert gas source of supply 32 is connected to this supplied-air nozzle 29 through the airpipe 30 and the supplied-air valve 31, and the supplied air of the inert gas, such as nitrogen gas supplied to the supplied-air nozzle 29 from this inert gas source of supply 32, is carried out to the closed space 25 formed with crevice 6a and the lid 27.

[0022] Moreover, the exhaust nozzle 33 is formed in the aforementioned lid 27, and the exhaust valve 35 for replacing the atmosphere in a closed space 25 by inert gas atmosphere from air atmosphere is connected to this exhaust nozzle 33 through the exhaust pipe 34.

[0023] With 1 operation gestalt of this invention constituted as mentioned above, if inert gas is supplied to an airpipe 30 from the inert gas source of supply 32 where the supplied-air valve 31 and an exhaust valve 35 are opened wide, the inert gas supplied to the airpipe 30 will circulate the supplied-air nozzle 29 prepared in the lid 27, and will flow into a closed space 25. polar-zone 14a of the piezoelectric device 14 held in a closed space 25 since the air in a closed space 25 circulated the exhaust nozzle 33 and the exhaust pipe 34, and was discharged from the exhaust valve 35 at this time and a closed space 25 was replaced by inert gas atmosphere from air atmosphere by this, and electric supply -- oxidization of a member 15 can be prevented. Therefore, with 1 operation gestalt of this invention, since it becomes possible to stabilize and supply electric power in a RF at the polar zone 14a and 14b of a piezoelectric device 14, it is always efficient and the particle adhering to the washed object 1 can be removed.



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[0024] moreover -- since the moisture in air does not dew even if a piezoelectric device 14 generates heat by replacing a closed space 25 by inert gas atmosphere from air atmosphere -- polar-zone 14a of a piezoelectric device 14, and electric supply -- oxidization of a member 15 can be prevented

[0025] Moreover, since the gas pressure of inert gas acts on the upper surface of the oscillating object 10 by making it identically to the fluid pressure of the penetrant remover which spouts the gas pressure of the inert gas which flowed into a closed space 25 from the penetrant remover exhaust nozzle 7, or high, the seal nature of the oscillating object 10 and packing 12 can be raised.

[0026] That is, a pressure plate 13 is formed in the oscillating object 10 at the periphery section, and this pressure plate 13 is fixed to the inner pars basilaris ossis occipitalis of crevice 6a with two or more screw threads 11. Therefore, although the periphery of a screw thread 11 was bound tight firmly and the inferior surface of tongue of the oscillating object 10 has stuck to packing 12, it \*\*\*\*s with a screw thread 11 and is weaker than the bolting force of the periphery of a screw thread 11 between 11. In addition, when a pressure differential arises [ the fluid pressure of the penetrant remover of the oscillating object 10 bottom / the closed space 25 of the high-pressure and oscillating object 10 top ] among both in low voltage at the time of penetrant remover jet, a crevice is generated in the part where the bolting force between the oscillating object 10 and packing 12 is weak, and there is a possibility that a penetrant remover may leak from this crevice.

[0027] However, since according to 1 operation gestalt of this invention it was made higher identically to the fluid pressure of the penetrant remover which spouts the gas pressure in a

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closed space 25 from the penetrant remover exhaust nozzle 7 than it as mentioned above, and the oscillating object 10 is pushed against packing 12 with gas pressure, a crevice is not generated between the oscillating object 10 and packing 12, and a penetrant remover does not leak to a closed space 25.

[0028] Moreover, by pressing the oscillating object 10 below with gas pressure as mentioned above, the oscillating sheet metal-like object 10 can lenticulate, and cannot carry out, and the oscillation mode of the oscillating object 10 can be regulated only to lengthwise.

[0029] In addition, this invention is not limited to 1 operation gestalt mentioned above. for example, -- 1 operation gestalt mentioned above -- a piezoelectric device 14 and electric supply - - although the supplied-air nozzle 29 and the exhaust nozzle 33 were formed in the lid 27 in order to replace the atmosphere in the closed space 25 in which the member 15 was held by inert gas atmosphere from air atmosphere, if inert gas is beforehand enclosed in a closed space 25, it is not necessary to necessarily form the supplied-air nozzle 29 and an exhaust nozzle 33 in a lid 27

[0030] moreover -- 1 operation form mentioned above -- a piezoelectric device 14 and electric supply -- the inside of the closed space 25 in which the member 15 was held -- inert gas -- a supplied air -- carrying out -- electrode section 14a of a piezoelectric device 14, and electric supply -- although oxidization of a member 15 was prevented, the same effect can be acquired even if it carries out the supplied air of the dried air instead of inert gas

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**[Problem(s) to be Solved by the Invention]** Since a washed object did not need to be immersed into the penetrant remover, although the reattachment of a particle could be prevented according to the ultrasonic cleaner of the above shower methods, it had the following technical problems.

That is, in the washing station mentioned above, since the electric supply member in contact with the polar zone of a piezoelectric device or a piezoelectric device is exposed into air, the polar zone and electric supply member of a piezoelectric device oxidize gradually, and, thereby, an oxide film is formed between the polar zone of a piezoelectric device, and an electric supply member. And a piezoelectric device stops having operated normally with growth of this oxide film, and there was a problem that the removal efficiency of a particle fell in connection with this.

[0006] what was made in view of the trouble which mentioned this invention above -- it is -- the purpose -- the polar zone of a piezoelectric device, and electric supply -- oxidization of a member can be prevented and it is going to offer the ultrasonic cleaner which is always efficient and can remove the particle adhering to the washed object

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**Effect of the Invention]** according to [ as explained above ] invention of a claim 1 and a claim 2 -- the polar zone of a piezoelectric device, and electric supply -- oxidization of a member can be prevented, it can continue at a long period of time, and a piezoelectric device can be operated normally Therefore, it is always efficient and the particle adhering to the washed object can be removed.

[0032] While being able to prevent [ according to invention of a claim 3 ] that a penetrant remover is revealed in a closed space from between an oscillating object and packing in addition to the effect by invention of a claim 1 or a claim 2, the oscillation mode of an oscillating object is controllable only to lengthwise.

**[Description of the Prior Art]** Generally, although a semiconductor wafer forms a semiconductor film, an insulator layer, etc. on the surface of a silicon substrate and it is constituted, if particles, such as dust, have adhered on the surface of a silicon substrate when manufacturing such a semiconductor wafer, the property of a semiconductor film or an insulator layer will fall and it will become difficult to acquire a desired semiconductor property and a desired insulating property. Therefore, when forming a semiconductor film, an insulator layer, etc. on the surface of a silicon substrate, it is necessary to wash a silicon substrate at the last process, and to remove a particle.

[0003] By the way, although the washing station which considered as the means which carries out washing removal of the particle adhering to the silicon substrate etc., and used the ultrasonic wave was known from the former, since this kind of ultrasonic cleaner had adopted the DIP method which is immersed into a penetrant remover in a washed object, and removes a particle, the particle which exfoliated from the washed object might re-adhere to the washed object.

[0004] Then, the ultrasonic cleaner called a shower method in recent years is developed, and practical use is presented. This kind of ultrasonic cleaner has the washing nozzle, and it is constituted so that penetrant removers, such as pure water, may be blown off from this washing nozzle in the shape of a shower and the washed field of a washed object may be washed. Moreover, this kind of ultrasonic cleaner has the oscillating object of a tabular in the penetrant remover exhaust nozzle of a washing nozzle, and the position which counters, and it is constituted so that this oscillating object may be vibrated by the piezoelectric device and an ultrasonic wave may be given to a penetrant remover.

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**The technical field to which invention belongs]** this invention relates to the ultrasonic cleaner used in for example, a semiconductor wafer, the manufacture process of a liquid crystal display, etc.

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**[Detailed Description of the Invention]**

[0001]

[The technical field to which invention belongs] this invention relates to the ultrasonic cleaner used in for example, a semiconductor wafer, the manufacture process of a liquid crystal display, etc.

[0002]

[Description of the Prior Art] Generally, although a semiconductor wafer forms a semiconductor film, an insulator layer, etc. on the surface of a silicon substrate and it is constituted, if particles, such as dust, have adhered on the surface of a silicon substrate when manufacturing such a semiconductor wafer, the property of a semiconductor film or an insulator layer will fall and it will become difficult to acquire a desired semiconductor property and a desired insulating property. Therefore, when forming a semiconductor film, an insulator layer, etc. on the surface of a silicon substrate, it is necessary to wash a silicon substrate at the last process, and to remove a particle.

[0003] By the way, although the washing station which considered as the means which carries out washing removal of the particle adhering to the silicon substrate etc., and used the ultrasonic wave was known from the former, since this kind of ultrasonic cleaner had adopted the DIP method which is immersed into a penetrant remover in a washed object, and removes a particle, the particle which exfoliated from the washed object might carry out the reattachment of it to the washed object.

[0004] Then, the ultrasonic cleaner called a shower method in recent years is developed, and practical use is presented. This kind of ultrasonic cleaner has the washing nozzle, and it is

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constituted so that penetrant removers, such as pure water, may be blown off from this washing nozzle in the shape of a shower and the washed field of a washed object may be washed.

Moreover, this kind of ultrasonic cleaner has the oscillating object of a tabular in the penetrant remover exhaust nozzle of a washing nozzle, and the position which counters, and it is constituted so that this oscillating object may be vibrated by the piezoelectric device and an ultrasonic wave may be given to a penetrant remover.

[0005]

[Problem(s) to be Solved by the Invention] Since a washed object did not need to be immersed into the penetrant remover, although the reattachment of a particle could be prevented according to the ultrasonic cleaner of the above shower methods, it had the following technical problems.

That is, in the washing station mentioned above, since the electric supply member in contact with the polar zone of a piezoelectric device or a piezoelectric device is exposed into air, the polar zone and electric supply member of a piezoelectric device oxidize gradually, and, thereby, an oxide film is formed between the polar zone of a piezoelectric device, and an electric supply member. And a piezoelectric device stops having operated normally with growth of this oxide film, and there was a problem that the removal efficiency of a particle fell in connection with this.

[0006] what was made in view of the trouble which mentioned this invention above -- it is -- the purpose -- the polar zone of a piezoelectric device, and electric supply -- oxidization of a member can be prevented and it is going to offer the ultrasonic cleaner which is always efficient and can remove the particle adhering to the washed object

[0007]



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[Means for Solving the Problem] In order to solve the above-mentioned technical problem, invention of a claim 1 The washing nozzle which has the penetrant remover exhaust nozzle which spouts a penetrant remover to a washed object, The oscillating object of the tabular which countered the aforementioned penetrant remover exhaust nozzle and was fixed to the aforementioned washing nozzle, In the ultrasonic cleaner possessing the piezoelectric device which gives an ultrasonic wave to the penetrant remover which this oscillating object is vibrated and is spouted from the aforementioned penetrant remover exhaust nozzle, and the electric supply member which contacts the polar zone of this piezoelectric device and supplies electric power to the aforementioned piezoelectric device in high-frequency voltage The closed space which holds the aforementioned piezoelectric device and the aforementioned electric supply member in the aforementioned washing nozzle is formed, and it is characterized by making the inside of this closed space into inert gas atmosphere or dried-air atmosphere.

[0008] The washing nozzle for which invention of a claim 2 has the penetrant remover exhaust nozzle which spouts a penetrant remover to a washed object, The oscillating object of the tabular which countered the aforementioned penetrant remover exhaust nozzle and was fixed to the aforementioned washing nozzle, In the ultrasonic cleaner possessing the piezoelectric device which gives an ultrasonic wave to the penetrant remover which this oscillating object is vibrated and is spouted from the aforementioned penetrant remover exhaust nozzle, and the electric supply member which contacts the polar zone of this piezoelectric device and supplies electric power to the aforementioned piezoelectric device in high-frequency voltage While forming the closed space which holds the aforementioned piezoelectric device and the aforementioned electric supply member in the aforementioned washing nozzle It is characterized by establishing

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a flueing means to establish the gas supplied-air means which carries out the supplied air of inert gas or the dried air in this closed space, and to exhaust the aforementioned inert gas or the aforementioned dried air out of the aforementioned closed space.

[0009] Invention of a claim 3 is that the hydrostatic pressure in the aforementioned closed space is the same as that of the fluid pressure of the penetrant remover spouted from the aforementioned penetrant remover exhaust nozzle, or a thing characterized by the high thing in invention of a claim 1 or a claim 2.

[0010]

**[Embodiments of the Invention]** Hereafter, 1 operation gestalt of this invention is explained with reference to drawing 1 and drawing 2. Drawing 2 is the perspective diagram of the ultrasonic cleaner concerning 1 operation gestalt of this invention, and the conveyer by which one in drawing conveys a washed object and 2 conveys a washed object 1, and 3 show the washing nozzle of the prismatic which sprays a penetrant remover on the upper surface (washed field) of the washed object 1 laid on the conveyer 2 in the shape of a shower.

[0011] As the aforementioned washing nozzle 3 is shown in drawing 1, it has the lower material 4 of a tabular, the packing 5 prepared in the upper surface of this lower material 4, and the up material 6 of the prismatic which is fixed to the lower material 4 through this packing 5, and has crevice 6a on the upper surface, and the penetrant remover exhaust nozzle 7 is formed in the inferior surface of tongue of the aforementioned lower material 4.

[0012] Opening of the aforementioned penetrant remover exhaust nozzle 7 is carried out long and slender along the cross direction of a conveyer 2, and the diffuser space 8 for raising the fluid pressure of a penetrant remover is formed in the end of this penetrant remover exhaust

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nozzle 7.

[0013] Moreover, the aforementioned washing nozzle 3 has the penetrant remover feed hopper (not shown), and the penetrant remover which flowed from this penetrant remover feed hopper circulates the liquid supply way 9 formed in the interior of the washing nozzle 3, and flows into end opening 8a of the aforementioned diffuser space 8.

[0014] The oscillating object 10 of the shape of sheet metal which consists of metallic materials, such as a tantalum, counters the penetrant remover exhaust nozzle 7, and is prepared in end opening 8a of the aforementioned diffuser space 8. The periphery section of this oscillating object 10 is being fixed to the up material 6 of the washing nozzle 3 through packing 12 with two or more screw threads 11, and the piezoelectric device 14 is formed in the upper surface center section. And two or more pressure plates 13 are formed in the upper surface periphery section of the aforementioned oscillating object 10, and the aforementioned screw thread 11 is screwed in tapped hole 6a which penetrated the breakthrough formed in a pressure plate 13, the oscillating object 10, and packing 12, and was prepared in the inner base of the aforementioned crevice 6a.

[0015] The aforementioned piezoelectric device 14 is formed by piezoelectric material, such as a barium titanate, and the sheet metal-like polar zone 14a and 14b is formed in both sides of this piezoelectric device 14. these polar zone 14a and 14b is formed by metallic materials, such as aluminum, -- having -- \*\*\*\* -- polar-zone 14a -- electric supply -- the point of a member 15 has contacted In addition, polar-zone 14b is being fixed to the upper surface of the oscillating object 10 by conductive adhesives.

[0016] the aforementioned electric supply -- a member 15 bends the sheet metal which consists of metals, such as copper, in the shape of J character, is formed, and carries out [ the amount of

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point ] elastic deformation according to the oscillating phenomenon of a piezoelectric device 14

[0017] the aforementioned electric supply -- the end face section of a member 15 -- a screw thread 16 -- the metal of L typeface -- it is fixed to the member 17 this metal -- the member 17 is formed above the piezoelectric device 14, and is being fixed to the undersurface of a metal plate 19 with the screw thread 18

[0018] The aforementioned metal plate 19 is supported above the piezoelectric device 14 with the insulating tube 22 which covers the thread part of two or more screw threads 21 which extended from the upper surface of a pressure plate 13, and this screw thread 21, and the end of a coil 23 is in contact with the upper surface of this metal plate 19. In addition, the nose of cam of the aforementioned screw thread 21 is in contact with the upper surface of the oscillating object 10.

[0019] The aforementioned coil 23 is formed by metallic materials, such as copper, and the electric supply terminal 24 is formed in the other end of this coil 23. And the non-illustrated RF generator is connected to the aforementioned electric supply terminal 24 through the electric supply cable (not shown). the high-frequency voltage supplied to the electric supply terminal 24 from this RF generator -- a coil 23, a metal plate 19, and a metal -- a member 17 and electric supply -- pass a member 15, while electric power is supplied by electrode section 14a of a piezoelectric device 14 Electric power is supplied by electrode section 14b of a piezoelectric device 14 through a coil 23, a metal plate 19, a screw thread 21, and the oscillating object 10.

[0020] the aforementioned oscillating object 10, a piezoelectric device 14, and electric supply -- the member 15, the metal plate 19, the coil 23, and the electric supply terminal 24 are held in crevice 6a formed in the up material 6 of the washing nozzle 3 This crevice 6a is airtightly sealed

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with the lid 27 prepared in the upper surface of the up material 6 through packing 26, and forms a closed space 25 with this lid 27.

[0021] The aforementioned lid 27 is being fixed to the upper surface of the up material 6 with two or more screw threads 28, and the supplied-air nozzle 29 is formed in this lid 27. The inert gas source of supply 32 is connected to this supplied-air nozzle 29 through the airpipe 30 and the supplied-air valve 31, and the supplied air of the inert gas, such as nitrogen gas supplied to the supplied-air nozzle 29 from this inert gas source of supply 32, is carried out to the closed space 25 formed with crevice 6a and the lid 27.

[0022] Moreover, the exhaust nozzle 33 is formed in the aforementioned lid 27, and the exhaust valve 35 for replacing the atmosphere in a closed space 25 by inert gas atmosphere from air atmosphere is connected to this exhaust nozzle 33 through the exhaust pipe 34.

[0023] With 1 operation form of this invention constituted as mentioned above, if inert gas is supplied to an airpipe 30 from the inert gas source of supply 32 where the supplied-air valve 31 and an exhaust valve 35 are opened wide, the inert gas supplied to the airpipe 30 will circulate the supplied-air nozzle 29 prepared in the lid 27, and will flow into a closed space 25. electrode section 14a of the piezoelectric device 14 held in a closed space 25 since the air in a closed space 25 circulated the exhaust nozzle 33 and the exhaust pipe 34, and was discharged from the exhaust valve 35 at this time and a closed space 25 was replaced by inert gas atmosphere from air atmosphere by this, and electric supply -- oxidization of a member 15 can be prevented Therefore, with 1 operation form of this invention, since it becomes possible to stabilize and supply electric power in a RF at the electrode sections 14a and 14b of a piezoelectric device 14, it is always efficient and the particle adhering to the washed object 1 can be removed.

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[0024] moreover -- since the moisture in air does not dew even if a piezoelectric device 14 generates heat by replacing a closed space 25 by inert gas atmosphere from air atmosphere -- polar-zone 14a of a piezoelectric device 14, and electric supply -- oxidization of a member 15 can be prevented

[0025] Moreover, since the gas pressure of inert gas acts on the upper surface of the oscillating object 10 by making it identically to the fluid pressure of the penetrant remover which spouts the gas pressure of the inert gas which flowed into a closed space 25 from the penetrant remover exhaust nozzle 7, or high, the seal nature of the oscillating object 10 and packing 12 can be raised.

[0026] That is, a pressure plate 13 is formed in the oscillating object 10 at the periphery section, and this pressure plate 13 is fixed to the inner pars basilaris ossis occipitalis of crevice 6a with two or more screw threads 11. Therefore, although the periphery of a screw thread 11 was bound tight firmly and the inferior surface of tongue of the oscillating object 10 has stuck to packing 12, it \*\*\*\*s with a screw thread 11 and is weaker than the bolting force of the periphery of a screw thread 11 between 11. In addition, when a pressure differential arises [ the fluid pressure of the penetrant remover of the oscillating object 10 bottom / the closed space 25 of the high-pressure and oscillating object 10 top ] among both in low voltage at the time of penetrant remover jet, a crevice is generated in the part where the bolting force between the oscillating object 10 and packing 12 is weak, and there is a possibility that a penetrant remover may leak from this crevice.

[0027] However, since according to 1 operation gestalt of this invention it was made higher identically to the fluid pressure of the penetrant remover which spouts the gas pressure in a

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closed space 25 from the penetrant remover exhaust nozzle 7 than it as mentioned above, and the oscillating object 10 is pushed against packing 12 with gas pressure, a crevice is not generated between the oscillating object 10 and packing 12, and a penetrant remover does not leak to a closed space 25.

[0028] Moreover, by pressing the oscillating object 10 below with gas pressure as mentioned above, the oscillating sheet metal-like object 10 can lenticulate, and cannot carry out, and the oscillation mode of the oscillating object 10 can be regulated only to lengthwise.

[0029] In addition, this invention is not limited to 1 operation gestalt mentioned above. for example, -- 1 operation gestalt mentioned above -- a piezoelectric device 14 and electric supply - although the supplied-air nozzle 29 and the exhaust nozzle 33 were formed in the lid 27 in order to replace the atmosphere in the closed space 25 in which the member 15 was held by inert gas atmosphere from air atmosphere, if inert gas is beforehand enclosed in a closed space 25, it is not necessary to necessarily form the supplied-air nozzle 29 and an exhaust nozzle 33 in a lid 27

[0030] moreover -- 1 operation form mentioned above -- a piezoelectric device 14 and electric supply -- the inside of the closed space 25 in which the member 15 was held -- inert gas -- a supplied air -- carrying out -- electrode section 14a of a piezoelectric device 14, and electric supply -- although oxidization of a member 15 was prevented, the same effect can be acquired even if it carries out the supplied air of the dried air instead of inert gas

[0031]

[Effect of the Invention] according to [ as explained above ] invention of a claim 1 and a claim 2 -- the electrode section of a piezoelectric device, and electric supply -- oxidization of a member can be prevented, it can continue at a long period of time, and a piezoelectric device can be

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operated normally Therefore, it is always efficient and the particle adhering to the washed object can be removed.

[0032] While being able to prevent [ according to invention of a claim 3 ] that a penetrant remover is revealed in a closed space from between an oscillating object and packing in addition to the effect by invention of a claim 1 or a claim 2, the oscillation mode of an oscillating object is controllable only to lengthwise.



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**[Claim(s)]**

[Claim 1] The washing nozzle which has the penetrant remover exhaust nozzle which spouts a penetrant remover to a washed object. The oscillating object of the tabular which countered the aforementioned penetrant remover exhaust nozzle and was fixed to the aforementioned washing nozzle. The piezoelectric device which gives an ultrasonic wave to the penetrant remover which this oscillating object is vibrated and is spouted from the aforementioned penetrant remover exhaust nozzle. the electric supply which contacts the polar zone of this piezoelectric device and supplies electric power to the aforementioned piezoelectric device in a RF -- a member It is the ultrasonic cleaner equipped with the above, and the closed space which holds the aforementioned piezoelectric device and the aforementioned electric supply member in the aforementioned washing nozzle is formed, and it is characterized by making the inside of this closed space into inert gas atmosphere or dried-air atmosphere.

[Claim 2] The washing nozzle which has the penetrant remover exhaust nozzle which spouts a penetrant remover to a washed object. The oscillating object of the tabular which countered the aforementioned penetrant remover exhaust nozzle and was fixed to the aforementioned washing nozzle. The piezoelectric device which gives an ultrasonic wave to the penetrant remover which this oscillating object is vibrated and is spouted from the aforementioned penetrant remover exhaust nozzle. the electric supply which contacts the polar zone of this piezoelectric device and supplies electric power to the aforementioned piezoelectric device in a RF -- a member It is the ultrasonic cleaner equipped with the above, and while forming the closed space which holds the aforementioned piezoelectric device and the aforementioned electric supply member in the aforementioned washing nozzle, it is characterized by establishing an exhaust air means to

